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A DEVICE FOR THE MANUFACTURE OF A SEMICONDUCTOR

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Detailed explanation of the invention

Objective of the invention

Industrial application field

The present invention concerns a device for the manufacture of a semiconductor.

Prior art

Typically, conventional devices for manufacturing semiconductors (e.g., CVD devices and etching devices), which involve conducting a treatment allowing specific reactive gases to act on a to-be-treated substrate, are configured in such a manner that the treatment of forming a CVD film or etching involves the action of specific reactive gases to be conducted in an ambient-pressure atmosphere or reduced-pressure atmosphere.

Problems to be solved by the invention

As described above, according to conventional devices for manufacturing semiconductors (e.g., CVD devices and etching devices), which involve conducting a treatment allowing specific reactive gases to act on a to-be-treated substrate, the treatment is conducted by allowing specific reactive gases to act on a to-be-treated substrate (e.g., a semiconductor wafer) in an ambient-pressure atmosphere or reduced-pressure atmosphere. However, it has been desired that the film-forming speed and throughput of

these devices for manufacturing semiconductors can be improved. Furthermore, in particular, when the treatment is conducted in a reduced-pressure atmosphere and a low-boiling-point substrate film material is used, a large amount of this low-boiling-point substrate film material is evaporated away, which is problematic.

The present invention offers a device for the manufacture of a semiconductor, which provides a solution to the above-mentioned problems, thereby allowing the film-forming speed to be improved in comparison with that of conventional methods and preventing volatile substances (e.g., low-boiling-point substrate film materials) from being evaporated away.

Structure of the invention

Means to solve the problems

Specifically, the present invention offers a device for the manufacture of a semiconductor, wherein said device for manufacturing a semiconductor, which involves conducting a treatment allowing specific reactive gases to act on a to-be-treated substrate, is characterized by the fact of being equipped with a means of supplying the above-mentioned treatment gases in a pressurized manner.

Action

The semiconductor-manufacturing device of the present invention with the above-mentioned structure is equipped with a means of supplying treatment gases in a pressurized manner; the

treatment can be conducted by pressurizing the treatment gases and performing the treatment in a high-pressure treatment-gas atmosphere. Accordingly, in comparison with conventional methods, the treatment pertaining to the present invention can be conducted at a higher speed in a higher density treatment-gas atmosphere. Additionally, the use of a high-pressure treatment-gas atmosphere can also prevent low-boiling-point substrate film materials and the like from being evaporated away.

Application examples

Next, the present invention, which can be used in an etching device for applications, such as removing a photoresist deposited onto a semiconductor wafer, LCD substrate, or the like, as well as removing ink and removing various solvents, is described by means of an application example together with a figure.

A to-be-treated substrate, such as a semiconductor wafer (3), is placed inside a chamber (2) of an etching device (1), which is equipped with a heating plate (4) for heating the semiconductor wafer (3) and a gas-diffusion plate (5), which faces the heating plate (4).

A diffusion-plate positioning device (6) is connected to the above-mentioned gas diffusion plate (5) in such a manner that a desired distance between the semiconductor wafer (3) and the gas diffusion plate can be attained. Additionally, the gas diffusion plate (5) is equipped with openings for the treatment gases (e.g., ozone-containing gases) to be ejected and openings for waste gases to be discharged. For example, a multiple number of

gas-ejecting slits (7) and waste-gas-discharging slits (8) are alternately installed.

Moreover, a pressurizing device (10) comprising a plunger pump, bellows pump, diaphragm pump or the like is connected to the above-mentioned gas-ejecting slits (7) via a flow regulator (9). Also, an ozone-generating device (12), which generates ozone from oxygen fed from an oxygen-supplying device (11), and a secondary gas-excitation device (14), which brings about the excitation of a secondary gas fed from a secondary gas-supplying device (13), are connected to the pressurizing device (10). Additionally, ozone-generating devices, which generate ozone by means of soundless discharge, corona discharge, glow discharge, and the like, can be used as the ozone-generating device (12).

Meanwhile, the waste-gas-discharging slits (8) are connected to the plant's exhaust-gas system or the like via the pressure regulator (15) and exhaust-gas neutralization device (16).

Moreover, the heating plate (4) is equipped with a multiple number of pins (18) (e.g., three pieces), which are connected to the substrate positioning device (17) in such a manner that these pins (18) penetrate through the heating plate (4), thereby providing a configuration with which the semiconductor wafer (3) can be kept on these three pins (18) during loading and unloading.

Additionally, the side of the chamber (2) is equipped with a gate mechanism (19) for loading and unloading, with a substrate-sending device (20) being installed next to the gate mechanism (19) for the purpose of loading and unloading the semiconductor wafer (3) from the chamber (2).

For example, an etching treatment can be conducted on a semiconductor wafer (3) in the manner described below, using the etching device (1) with the above-mentioned configuration.

Specifically, the gate mechanism (19) is opened and the semiconductor wafer (3) is sent to the heating plate (4) inside the chamber (2) by means of the substrate-sending device (20). Additionally, the gas diffusion plate (5) is raised beforehand by means of the diffusion-plate positioning device (6), so that a sufficient gap is formed between the heating plate (4) and the gas diffusion plate (5).

Next, the pins (18) are raised by means of the substrate positioning device (17), so that the semiconductor wafer (3) can be transferred from the substrate-sending device (20) onto the pins (18).

Afterwards, the transporting arm of the substrate-sending device (20) is caused to move backward, and the gate mechanism (19) is closed. At the same time, the pins (18) are lowered by means of the substrate positioning device (17) so that the semiconductor wafer (3) is placed onto the heating plate (4), with the gap between the gas diffusion plate (5) and the semiconductor wafer (3) being set at the specified value by means of the diffusion-plate positioning device (6).

Next, an etching treatment is conducted in the following manner. The semiconductor wafer (3) is heated to the specified temperature by means of the heating plate (4). At the same time, an ozone-containing oxygen gas supplied by the ozone-generating device (12) and an excited secondary gas supplied by the secondary gas-excitation device (14) are pressurized to 2-20 atm, for example, by means of the pressurizing device (10), with the

flow rate being adjusted to 3-30 L/min, for example, by means of the flow regulator (9). These gases are then ejected from the gas-ejecting slits (7) of the gas diffusion plate (5) toward the semiconductor wafer (3), while the waste gas is discharged from the waste-gas-discharge slits (8).

Furthermore, the residual ozone in the exhaust gas is decomposed by the exhaust-gas neutralization device (16), with the neutralized exhaust gas then being sent to the plant's exhaust gas system. Also, the pressure inside the chamber (2) is maintained at the above-mentioned specified level (e.g., 2-20 atm) by means of the pressure regulator (15), as the above-mentioned exhaust gas is being discharged.

Accordingly, with the etching device (1) of the application example, an etching treatment can be conducted under a high-pressure atmosphere; such etching can be conducted at a high rate under an ozone density higher than that of conventional methods. Furthermore, as a result of using a high-pressure atmosphere, low-boiling-point substrate film materials (e.g., Cr, Ta, ITO, α-Si and, in particular, oxides thereof) are prevented from being evaporated away.

Moreover, according to the etching device (1) of the application example, the pressurizing device (10) is installed downstream from the ozone-generating device (12). Therefore, conventional ambient-pressure devices can be used on the upstream side of the pressurizing device (10) (e.g., ozone-generating device (12)), thereby preventing the cost of manufacturing the device of the present invention from being increased.

Additionally, the above-mentioned application example described one means of the present invention being applicable for

use in etching devices. However, the present invention is not limited to only this application example. For example, the present invention is also applicable for use in film-forming devices and devices for the manufacture of semiconductors that involve conducting a treatment allowing specific reactive gases to act on a to-be-treated substrate.

Effects of the invention

As described above, the present invention offers a device for the manufacture of a semiconductor, which allows the treatment speed and throughput to be improved in comparison with that of conventional methods. Additionally, volatile substances, such as low-boiling-point substrate film materials, are prevented from evaporating away.

Brief explanation of the figures

Figure 1 shows the configuration of an etching device used as an application example of the present invention.

(1) Etching device
(2) Chamber
(3) Semiconductor wafer
(4) Heating plate
(5) Gas diffusion plate
(6) Diffusion-plate positioning device
(7) Gas-ejecting slits
(8) Waste-gas-discharging slits

(9) Flow regulator
(10) Pressurizing device
(11) Oxygen-supplying device
(12) Ozone generator
(13) Secondary gas-supplying device
(14) Secondary gas-excitation device
(15) Pressure regulator
(16) Exhaust-gas neutralization device
(17) Substrate positioning device
(18) Pins
(19) Gate mechanism
(20) Substrate-sending device

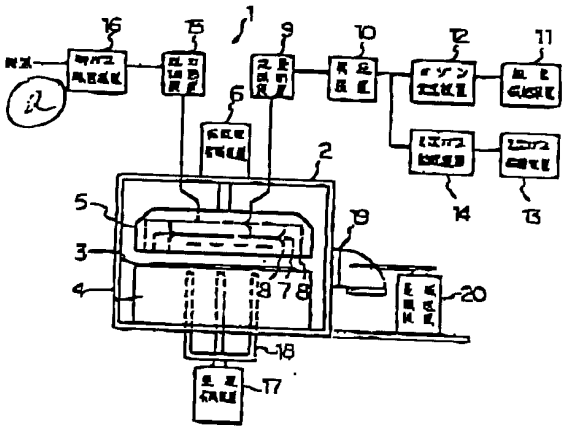

Figure 1

Key: a Exhaust gas
6 Diffusion-plate positioning device
9 Flow regulator
10 Pressurizing device
11 Oxygen-supplying device
12 Ozone generator
13 Secondary gas-supplying device
14 Secondary gas-excitation device
15 Pressure regulator
16 Exhaust-gas neutralization device
17 Substrate positioning device
20 Substrate-sending device